Detailed Course Description - Course Plan Development and Updating Procedures/ Computer Science \ Multimedia Systems Department	QF01/0408-3.0E

Faculty	Science & Information Technology	Department	Computer Science \ Multimedia Systems
Course number	**0105333**	**Course title**	**Image Processing**
Number of credit hours	3	Pre-requisite/co-requisite	0105

Brief course description

Digital image processing is the use of computer algorithms to perform image processing on digital images. As a subcategory or field of digital signal processing, digital image processing has many advantages over analog image processing. This course is an introduction to the fundamental concepts and techniques in basic digital image processing and their applications to solve real life problems. The topics covered include Digital Image Fundamentals, Image Transforms, Image Enhancement, Restoration and Compression, Morphological Image Processing, Nonlinear Image Processing, and Image Analysis. Application examples are also included.

In this course we try to explore the algorithms and techniques involved in Digital Image Processing using computational tools. The course will comprise of comprehensive understanding of signals, signal processing, digital imagery and digital image processing. Upon completion of this course, students will be familiar with basic image processing techniques for solving real problems. Student will also have sufficient expertise in both the theory of two-dimensional signal processing and its wide range of applications, for example, image restoration, image compression, and image analysis.

	Course goals and learning outcomes
Goal 1	Develop a fundamental understanding of digital image processing
Learning outcomes	1.1 Demonstrate a knowledge of a broad range of fundamental image processing 1.2 Apply image analysis techniques and concepts of linear and non-linear filtering. 1.3 The ability to understand theconcept of denoising, deblurring, edge detection, line finding, detection, morphological operators, compression, shape metrics and feature based recognition.
Goal 2	2 Develop an understanding of Image transform used in digital image processing
Learning outcomes	2.1 Identify and demonstrate the image transforming techniques 2.2 Analyze the image processing problems and recognizing effective solutions
Goal 3	3 Develop an understanding of image enhancement techniques and restoration methods
Learning outcomes	3.1 understand and use different image enhancement techniques 3.2 understand and use different image restoration methods
Goal 4	The ability to develop and apply the image compression and Segmentation techniques
Learning outcomes	4.1 understand and use different image compression techniques 4.2 understand and use different image segmentation techniques
Goal 5	Demonstrate ability in processing 2D images using the MATLAB image processing tools
Learning outcomes	5.1 create , read and write images 5.2 use and apply different image functions for segmentation 5.3 use and apply different image functions for detection and recognition
Textbook	"Digital Image Processing", Rafael C.Gonzalez, Richard E. Woods, etl , TMH , 4th

	Edition 2018.
Supplementary references	Tutorial 1. "Digital Image Processing using Matlab". R. C. Gonzalez, R. E. Woods, S. L. Eddins. Pearson-Prentice-Hall, 2004 **2.** "Fundamentals of Digital Image Processing", Anil K. Jain, Pearson Education, 2001. 3. "Digital Image Processing and Analysis", B. Chanda and D. Dutta Majumdar, PHI, 2003.

Course timeline				
Week	**Number of hours**	**Course topics**	**Pages (textbook)**	**Notes**
01	**1** **1** **1**	Elements of Visual Perception Structure of the Human Eye Image Formation in the Eye Brightness Adaptation and Discrimination Light and the Electromagnetic Spectrum	**1-38**	
02	**1** **1** **1**	Image Sensing and Acquisition Image Acquisition Using a Single Sensing Element Image Acquisition Using Sensor Strips Image Acquisition Using Sensor Arrays A Simple Image Formation Model Image Sampling and Quantization Basic Concepts in Sampling and Quantization	**40-49**	
03	**1** **1** **1**	Representing Digital Images Linear vs. Coordinate Indexing Spatial and Intensity Resolution Image Interpolation Some Basic Relationships Between Pixels Neighbors of a Pixel Adjacency, Connectivity, Regions, and Boundaries Distance Measures	**50-68**	
04	**1** **1** **1**	Introduction to the Basic Mathematical Tools Used in Digital Image Processing Elementwise versus Matrix Operations Linear versus Nonlinear Operations Spatial Operations Single-Pixel Operations Neighborhood Operations Geometric Transformations Image Registration Vector and Matrix Operations Image Transforms	**69-93**	
05	**1** **1** **1**	Fundamentals of Spatial Filtering The Mechanics of Linear Spatial Filtering Spatial Correlation and Convolution	**170-185**	

		Separable Filter Kernels		
06	**1 1 1**	**General Review, Exercises, and First Exam 20%**		
07	**1 1 1**	Digital image Representation Reading, Displaying, Writing Images using MATLAB Data Classes, Image Types using MATLAB Converting Between data classes and Image Types Introduction to M Function Programming using MATLAB	Tutorial 1	
08	**1 1 1**	Enhancement Using Arithmetic and Logic operations Combining Spatial Enhancement Methods Basics of Spatial Filters	Tutorial 1	
09	**1 1 1**	Smoothening and Sharpening Spatial Filters Intensity Transformation Function (MATLAB)	Tutorial 1	
10	**1 1 1**	Histogram Processing and Function Plotting (MATLAB) Image Enhancement in the Frequency Domain: Introduction to Fourier Transform and the frequency Domain Computing and Visualizing the 2D DFT (MATLAB)	Tutorial 1	
11	**1 1 1**	Smoothing Frequency Domain Filters Sharpening Frequency Domain Filters Homomorphic Filtering	Tutorial 1	
12	**1 1 1**	**Second Exam 20%**		
13	**1 1 1**	Image Restoration: Periodic Noise Reduction by Frequency Domain Filtering Linear Position-Invariant Degradations Estimation of Degradation Function	Tutorial 1	
14	**1 1 1**	Image Compression: Coding Interpixel and Psychovisual Redundancy Image Compression models Compression standards	Tutorial 1	
15	**1 1 1**	Image Segmentation: Detection of Discontinuities Edge linking and boundary detection Thresholding Object Recognition:	Tutorial 1	

		Patterns and Pattern Classes Decision-Theoretic Methods		
16	**1 1 1**	**Final Exam 50%**		

Theoretical course evaluation methods and weight	Participation = 10% First exam 20% Second exam 20% Final exam 50%	**Practical (clinical) course evaluation methods**	Semester students' work = 50% (Reports, research, quizzes, etc.) Final exam = 50%

Approved by head of department		**Date of approval**	

Extra information (to be updated every semester by corresponding faculty member)

Name of teacher	Sokyna ALQATAWNEH	Office Number	
Phone number (extension)		Email	S.qatawneh@zuj.edu.jo
Office hours			